REMARKS

Claims 1-2 and 4-23 are pending in the application. In the Final Office Action mailed on November 28, 2007, the Examiner took the following action: (1) rejected claims 1-2, 4-5, 7-12, 15-18 under 35 U.S.C. §103(a) as being unpatentable over Bour (EP 977,279) in view of Wu ("Superior Radiation Resistance of InGaN Alloys"); (2) rejected claims 6 and 13-14 under 35 U.S.C. §103(a) as being unpatentable over Bour in view of Wu, in further view of Schetzina (U.S. 6,046,464); (3) rejected claims 19-21 under 35 U.S.C. §103(a) as being unpatentable over Bour in further view of Nishii (U.S. Pub. 2003/0205271); (4) rejected claim 22 under 35 U.S.C. §103(a) as being unpatentable over Bour in further view of Wu; (5) rejected claim 23 under 35 U.S.C. §103(a) as being unpatentable over Takayama (U.S. 6,521,917) in view of Bour, and in further view of Wu. Applicant hereby amends claims 1, 19, and 22-23. Claim 6 is canceled without prejudice or disclaimer. Applicant respectfully traverses the rejections, request entry of the above-proposed amendment, as well as reconsideration of the application in view of the foregoing amendment and the following remarks.

I. Examiner Interview

Applicant respectfully expresses appreciation to Examiner Hall for the telephonic interview conducted on February 4, 2008 discussing the disposition of this case with Applicant's undersigned representative. During the interview, Applicant and the Examiner discussed the claim rejections, in particular the elements of Claim 6, in view of the disclosure in Column 7, Lines 17-43 of U.S. 6,046,464 to Schetzina. No agreement was reached regarding the allowability of the claims.

II. Rejections under 35 U.S.C. §103(a)

Bour (EP 977,276)

Bour discloses a method for forming group III-V nitride films on a substrate. (Column 2, Lines 17-18). The substrate is usable to form short-wavelength visible light-emitting optoelectronic devices, including light-emitting diodes and diode lasers. (Column 2, Lines 18-20). Specifically, Bour provides a method for the growth of light-emitting device heterostructures over a thick InGaN layer that provides a suitable bandgap for blue, green, or red light emissions. (Column 2, Lines 21-24).

Wu (Superior Radiation Resistance of InGaN Alloys)

Wu discloses tandem solar cells based on group III-V semiconductor alloys. The tandem solar cells are resistant to high-energy radiation damage. (Abstract).

Nishii (U.S. Pub. 2003/0205721)

Nishii disclose semiconductor device that includes an active region from a group III nitride semiconductor grown on a substrate and an insulating oxide film. (Paragraph 16, Lines 1-5).

Takayama (U.S. 6,521,917)

Takayama discloses a group III-nitride quaternary material for use in semiconductor structures. (Column 1, Lines 8-10). The group III-nitride quaternary material is configured to reduces or eliminates phase separation and provides increased emission efficiency. (Column 2, Lines 59-64).

Schetzina (U.S. 6,046,464)

Schetzina discloses an integrated heterostructure of Group III-V nitride compound semiconductors. (Column 5, Lines 59-61). The integrated heterostructure is formed on a multicomponent platform which includes a substrate of monocrystalline silicon carbide and a non-nitride buffer layer of monocrystalline zinc oxide. (Column 6, Lines 14-29).

Claims 1-2, 4-5, 7-12, and 15-18

Claims 2, 4-5 and 7-12 and 15-18 depend from claim 1. Claim 3 is canceled. Claim 1, as amended, recites:

> 1. A multi-junction solar cell assembly comprising:
> a transparent substrate;
> a transparent conductive coating formed on the transparent substrate, said transparent conductive coating comprising gallium nitride;
> a plurality of gallium indium nitride junction layers formed successively on the transparent conductive coating;
> an indium nitride junction layer formed on the plurality of gallium indium nitride junction layers; and
> a metallization layer formed on the indium nitride junction layer,
> wherein each successive gallium indium nitride junction layer has a thickness greater than a thickness of the immediately preceding gallium indium nitride junction layer, each successive gallium indium nitride junction layer being directly adjacent the immediately preceding gallium indium nitride junction layer

Applicant respectfully traverses the rejections. In particular, as noted in the Office Action, Bour does not teach or suggest, "each successive layer of the plurality of gallium indium nitride junction layers has a thickness greater than a thickness of *the immediately preceding layer* of the plurality of gallium indium nitride junction layers, each successive layer being *directly adjacent the immediately preceding layer,*" as recited in claim 1. (Emphasis added). (Office Action, Page 7, Lines 1-6). This limitation is incorporated from Claim 6, which is now canceled.

Moreover, the deficiencies of Bour are not remedied by Wu. Wu discloses photovoltaic materials for forming multi-junction cells, but is silent with respect to the thickness of "the plurality of gallium indium nitride junction layers" that are recited in Claim 1. Further, since this limitation is incorporated from Claim 6, the distinction between this limitation and Schetzina (which is cited to reject Claim 6) is further discussed.

Specifically, the deficiencies of Bour and Wu with respect to this limitation are not remedied by Schetzina. Schetzina discloses a doped multiple quantum well (MQW) that includes "*alternating* layers of the *first* binary Group III-V nitride compound semiconductor material or an alloy thereof and a *second* binary Group III-V nitride compound semi-conductor material or an alloy thereof, on the first layer." (Emphasis added). (Column 7, Lines 30-35).

Further, Schetzina specifically discloses that the "thickness of the layers of the *second binary* Group III-V nitride compound semiconductor material or an alloy thereof in the MQW structure increases from adjacent the first layer to opposite the first layer." (Emphasis added). (Column 7, Lines 37-40). In other words, Schetzina discloses that *only* the second binary layers of the alternating layers of its MQW structure vary in thickness. However, Schetzina does not teach or suggest that the first binary layers of its MQW structure, which alternate with the second binary layers, vary in thickness. Accordingly, Schetzina cannot teach or suggest, "each successive layer of the plurality of gallium indium nitride junction layers has a thickness greater than a thickness of *the immediately preceding layer* of the plurality of gallium indium nitride junction layers, each successive layer being *directly adjacent the immediately preceding layer,*" as recited in claim 1. (Emphasis added).

Second, Schetzina also discloses a MQW structure that includes "alternating layers of aluminum nitride or aluminum gallium nitride and gallium nitride or an alloy thereof," wherein the thickness of gallium nitride increases. (Column 7, Lines 44-49). However, since this teaching of Schetzina discloses a MQW structure having alternating layers of three nitride compounds, it

cannot teach or suggest "a plurality of gallium indium nitride junction layers" (layers of one chemical type) that vary in thickness.

Third, the teachings of Schetzina regarding "graded" layers also does not teach or suggest vary the thickness of layers. Schetzina teaches that the ohmic contacts 120a and 120b include "graded" layers 122a and 122b, the "graded" in this instance refers to the concentration of the elements that make up the layers rather than the thickness of the layers. (Column 10, Lines 49-53). This is evident by the fact that Schetizina further discloses that "the continuously graded $Al_{1-y}Ga_yN$ layers 112a and 112b may be linearly *graded* such that the concentration of gallium increases from y=x at the interface with $Al_{1-x}Ga_xN$ cladding layers 114a and 114b, to y=1 at the interfaces with the GaN layers 124a and 124b." (Emphasis added). (Column 10, Lines 66-67, Column 11, Lines 1-3). As a result, Schetzina discloses the varying of concentration of elements in the layers to improve efficiency, rather than the varying the thickness of the layers to improve efficiency.

Thus, the cited references to Bour and Wu, whether individually or in combination, do not disclose, teach or fairly suggest, "each successive layer of the plurality of gallium indium nitride junction layers has a thickness greater than a thickness of *the immediately preceding layer* of the plurality of gallium indium nitride junction layers, each successive layer being *directly adjacent the immediately preceding layer*," as recited in Claim 1.

Furthermore, because claims 2, 4-5, 7-12 and 15-18 depend from claim 1, they are also allowable over the cited references for at least the same reasons that make claim 1 allowable, as well as for additional limitations recited in those claims.

Claims 6 and 13-14

Claims 6 and 13-14 depend from claim 1. Claim 6 is canceled. Applicant traverses the rejections. Specifically, Applicant incorporates the reasoning presented above in response to the

rejection of Claim 1 under 35 U.S.C. § 103(a). Accordingly, Applicant submits that that the cited references to Bour, Wu, and Schetzina, whether individually or in combination, do not teach or suggest, "each successive layer of the plurality of gallium indium nitride junction layers has a thickness greater than a thickness of *the immediately preceding layer* of the plurality of gallium indium nitride junction layers, each successive layer being *directly adjacent the immediately preceding layer*," as recited in Claim 1. (Emphasis added).

Furthermore, because claims 13-14 depend from claim 1, they are also allowable over the cited references for at least the same reasons that make claim 1 allowable, as well as for additional limitations recited.

Claims 19-21

Claims 20-21 depend from claim 19. Claim 19, as amended, recites:

> 19. A method of forming a multi-junction solar cell assembly comprising the steps of:
> forming a transparent conductive coating including gallium nitride on a substrate;
> forming a plurality of gallium indium nitride junction layers on the transparent conductive coating, wherein each successive gallium indium nitride junction layer has a thickness greater than a thickness of the immediately preceding gallium indium nitride junction layer, each successive gallium indium nitride junction layer being directly adjacent the immediately preceding gallium indium nitride junction layer; and
> forming a metallization layer on the plurality of gallium indium nitride junction layers, wherein the metallization layer is selected from a group that includes a layer of aluminum, a layer of chromium, and a layer of titanium.

Applicant respectfully traverses the rejections. In particular, as noted in the Office Action, Bour does not teach or suggest, "each successive layer of the plurality of gallium indium nitride junction layers has a thickness greater than a thickness of *the immediately preceding layer*

of the plurality of gallium indium nitride junction layers, each successive layer being *directly adjacent the immediately preceding layer,*" as recited in claim 1. (Emphasis added). (Office Action, Page 7, Lines 1-6).

Moreover, the deficiencies of Bour with respect to this limitation are not remedied by Nishii. Nishii discloses a multi-layer structure that includes a pad electrode 54. (Paragraph 131, Lines 1-8). However, Nishii is silent with respect to the thickness of layers in an assembly. Thus, the cited references to Bour and Nishii, whether individually or in combination, do not disclose, teach or fairly suggest the method of Claim 19.

Claim 22

Claim 22, as amended, recites:

> 22. A solar cell assembly comprising:
> a transparent substrate;
> a transparent conductive coating formed on the transparent substrate, said transparent conductive coating comprising gallium nitride;
> a plurality of gallium indium nitride junction layers formed directly on the transparent conductive coating in intimate contact with the transparent conductive coating, wherein each successive gallium indium nitride junction layer has a thickness greater than a thickness of the immediately preceding gallium indium nitride junction layer, each successive gallium indium nitride junction layer being directly adjacent the immediately preceding gallium indium nitride junction layer;; and
> a metallization layer formed on the plurality of gallium indium nitride junction layers.

Applicant respectfully traverses the rejection. In particular, Applicant incorporates the reasoning presented above in response to the rejection of Claim 1 under 35 U.S.C. § 103(a). Accordingly, Applicant submits that that the cited references to Bour and Wu, whether individually or in combination, do not teach or suggest, "each successive layer of the plurality of

gallium indium nitride junction layers has a thickness greater than a thickness of *the immediately preceding layer* of the plurality of gallium indium nitride junction layers, each successive layer being *directly adjacent the immediately preceding layer*," as recited in Claim 22. (Emphasis added).

Claim 23

Claim 23, as amended recites:

> 23. A multi-junction solar cell assembly comprising:
> a substrate having a first side and a second side opposite the first side;
> a metallization layer formed on the first side of the substrate;
> a collector grid formed on the second side of the substrate;
> a plurality of gallium indium nitride junction layers formed successively on the collector grid, wherein each successive gallium indium nitride junction layer has a thickness greater than a thickness of the immediately preceding gallium indium nitride junction layer, each successive gallium indium nitride junction layer being directly adjacent the immediately preceding gallium indium nitride junction layer;
> an indium nitride junction layer formed on the plurality of gallium indium nitride junction layers; and
> a glass cover on the indium nitride junction layer.

Applicant traverses the rejection. First, Takayama does not teach or suggest, "each successive layer of the plurality of gallium indium nitride junction layers has a thickness greater than a thickness of *the immediately preceding layer* of the plurality of gallium indium nitride junction layers, each successive layer being *directly adjacent the immediately preceding layer*," as recited in claim 23. (emphasis added). Instead, the disclosure of Takayama is related to a GaN cladding layer that is included directly underneath a Silicon Dioxide layer. (Column 8, Lines 48-50; Figures 7A-7E).

Moreover, Applicant incorporates the reasoning presented above in response to the rejection of Claim 1 under 35 U.S.C. § 103(a). Accordingly, Applicant submits that that the cited

references to Bour and Wu, whether individually or in combination, also do not teach or suggest this limitation. Thus, the deficiencies of Takayama with respect to this limitation are not remedied by Bour and Wu.

CONCLUSION

Applicant respectfully requests that the above-proposed amendments be entered and that pending Claims 1-2, 4-5, and 7-23 be allowed. If there are any remaining matters that may be handled by telephone conference, the Examiner is kindly invited to contact the undersigned attorney at the telephone number listed below.

Respectfully Submitted,

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